DOCUMENT RESUME

ED 155 009 SE 024 234

AUTHOR Hendel, Darwin D.
TITLE Evaluation of Mathematics Anxiety Programs.
PUB DATE Aug 77
NOTE 22p.; Paper Presented at the annual meeting of the American Psychological Association (85th, San Francisco, California, August 26-30, 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *College Mathematics; *Educational Programs; *Educational Research; *Evaluation; *Females; Higher Education; Mathematics Education; Student Behavior; Student Problems
IDENTIFIERS American Psychological Association; *Mathematics Anxiety

ABSTRACT

This paper, presented at the eighty-fifth Annual Convention of the American Psychological Association, examines the potential contribution of systematic evaluation of mathematics anxiety programs, outlines some important considerations in evaluating these programs, and presents illustrative data concerning the effectiveness of various components of a mathematics anxiety program designed especially for adult women who are returning to college. The initial pool of subjects for the study were the sixty-nine females participating in the Mathematics Anxiety Program (only two males participated). The program consisted of a diagnostic clinic, special mathematics instruction, and a support group. Results suggested that the most effective intervention strategy may be one which deals with the affective component and another which focuses on the cognitive aspect of the problem. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED155009

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Darwin D. Hendel

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

EVALUATION OF MATHEMATICS ANXIETY PROGRAMS

Darwin D. Hendel
Measurement Services Center
University of Minnesota

Paper presented at Division 17 symposium "Mathematics Anxiety and Counseling Psychology = An Exponential Challenge" held at the eighty-fifth Annual Convention of the American Psychological Association, San Francisco, August 26-30, 1977.

SE 024 234

CN000-292
3/28/78

Mathematics is part of daily life. It is also a critical "building block" for numerous college majors such as accounting and engineering. And specified levels of mathematics competency are pre-requisites for success in a variety of occupations which range from carpentry to nuclear physics. But millions of Americans are incompetent at mathematics and compulsively avoid any and all situations which require the use of mathematics (Tobias, 1976).

Although avoidance of mathematics poses problems for both women and men, there is reason to believe that it is more frequently present among women than among men. Male superiority in mathematics performance is no longer being accepted as an innate difference between women and men. A recent study by Fennema and Sherman (1977), together with the implications of Maccoby and Jacklin's (1974) review of sex differences, point to socio-cultural differences in how females and males are socialized concerning mathematics to account for differences in mathematics performance. One result of this socialization process may be the development of mathematics anxiety.

Mathematics anxiety has emerged as the affective variables which is frequently used in examining factors related to poor mathematics performance in females. Richardson and Suinn (1972) have defined mathematics anxiety as ". . . involving feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems . . ." (p. 551). Tobias (1976) discusses mathematics anxiety as stemming from ". . . a culture that makes mathematics ability a masculine attribute, that punishes women for doing well in mathematics, and that soothes the slower mathematics learner by telling her she does not have a 'mathematical mind'" (p. 57). And Lazarus (1974) is referring to the same constellation of symptoms when he refers to mathophobia as an irrational and impeditive dread of mathematics.

One symptom of mathematics anxiety is avoidance of mathematics, but continually avoiding mathematics probably leads to even higher levels of mathematics anxiety. Avoidance of mathematics has serious consequences for students, especially females, who graduate from high school with mathematics backgrounds which are inadequate for many college majors and for older females who have raised their families and are interested in occupations which require mathematics skills. Ernest (Note 3) noted large sex differences in university level mathematics courses: females are disproportionately enrolled in basic mathematics classes, female dropout rates from mathematics classes are almost double those for males, and attrition rates are higher among female mathematics majors than among males.

Given the probable importance of affective variables such as mathematics anxiety in the maintenance of avoidance of mathematics behaviors, the scarcity of research concerning the effectiveness of counseling intervention strategies to reduce mathematics anxiety and guidelines concerning procedures for evaluating mathematics anxiety programs is somewhat surprising. An exception is a summary by Richardson and Suinn (1972) of three studies concerning the effectiveness of behavior therapy for reducing mathematics anxiety; results of each of the three studies indicated statistically significant pre-to-post therapy reduction of mathematics anxiety.

The present paper examines the potential contribution of systematic evaluation of mathematics anxiety programs, outlines some important considerations in evaluating mathematics anxiety programs, and presents illustrative data concerning the effectiveness of various components (i.e., diagnostic clinic, support group, and mathematics instruction) of a mathematics anxiety program designed especially for adult women who are returning to college.

Systematic program evaluation can establish a useful information system for counselors and instructors who are in the process of developing and implementing programs for the treatment of mathematics anxiety. Program evaluation "gets people involved" in thinking about how they will achieve program objectives and may help the program and its staff to function more efficiently and effectively. This is what Scriven (1973) has referred to as the "formative" or diagnostic role which evaluation may play in developing and revising various components of a mathematics anxiety program. A particular question which often emerges in formative evaluation is "For whom is the program working?" By way of contrast, evaluation may be performed to determine the overall worth of a program in order to decide whether or not to continue the program. The evaluation community commonly refers to this type of evaluation as "summative" in nature. Although both types of evaluation are important, formative evaluation often is the preferred strategy (Ball, Note 1) for new programs. Some examples of newly developed mathematics anxiety programs are those at Mills College, Wellesley, Iowa State University, Wesleyan University, University of Minnesota, and Harvard University.

Evaluation of mathematics anxiety programs can occur at several points: 1) Before the program is developed, to answer questions such as the need (both in terms of the number of people who have mathematics anxiety and the intensity of this anxiety) for a mathematics anxiety program as well as the feasibility of developing such a program; 2) During the development of the program, to answer questions concerning the probably effectiveness of various program components; 3) When the program is functioning, to determine whether or not the program is operating as it was intended to operate; and 4) When a group of individuals has completed the program, to determine ways in which the program and its components (e.g., materials, counseling strategies, instructional efforts, etc.) may be improved. Figure 1 presents the sequence of events in the development, evaluation and revision of a typical mathematics anxiety program.

Insert Figure 1 about here

Evaluation of mathematics anxiety programs can be portrayed as follows: 1) It begins by asking the question "What are the consequences of the program?" rather than the more limiting question "What are the objectives of the program and to what extent did the program accomplish those objectives?" 2) Although experimental and control groups may sometimes be possible, evaluation of

mathematics anxiety programs are more likely to be explorations; and 3) Its purpose is to provide more complex bases for informed judgment concerning effective strategies for reducing mathematics anxiety.

Mathematics anxiety programs have several important characteristics to consider as they relate to evaluation: 1) programs consist of many different activities (e.g., recruitment of students, testing activities, counseling sessions, and mathematics instruction); 2) programs have multiple consequences, many of which are not specific program objectives; 3) mathematics anxiety programs interact with other educational and counseling activities in the system; 4) programs exist in a context which must be considered in designing an overall strategy for evaluation; 5) after a new mathematics anxiety program has been implemented successfully, the criteria used initially in evaluating the program are no longer sufficient; and 6) evaluation requires placing values on different criteria of program success.

The first step in evaluating a mathematics anxiety program is to clarify the purposes of the evaluation. This clarification process involves answering three questions: 1) How are the evaluative data to be used? 2) Who will use the evaluative data and what are the needs/skills of these various evaluation audiences? and 3) What judgments about the program are to be made? Although answering the first two questions is important, determining an answer to the third question is crucial because of its implications concerning the appropriate methodology to be used in the study. Some of the possible questions which can be explored are as follows: internal consistency of program design; the comparison between program design and program implementation; the comparison between outcome standards and actual program outcomes; the exploration of the relationships among program antecedents, transactions, and outcomes; the overall worth of the program; the relative worth of comparable programs; the cost effectiveness of competing programs; and the need for new programs.

Figure 2 contains a more explicit examination of the various levels at which evaluation of mathematics anxiety programs may occur. Determining appropriate levels of evaluation should emerge from the process of clarifying the purposes of the evaluation.

Insert Figure 2 about here

These various levels of evaluation can be placed within the context of well-known typologies for the categorization of evaluations. One such model is Stufflebeam's CIPP model (Stufflebeam, Foley, Gephart, Guba, Hammond, Merriman, and Provus, 1971) in which he examines evaluations which focus on the context, input, process or products of the educational activities. Figure 3 contains a summary of that model.

Insert Figure 3 about here

Although Stufflebeam's model includes a general discussion of appropriate methods for context, input, process and product evaluations, more comprehensive and specific guidelines concerning evaluation strategies have been developed. One such example is Ball and Anderson's (1975) discussion of sources of information (i.e., test scores, questionnaires, interviews, logs and diaries, ratings, clinical examinations, records, social indicators, expert opinion, and hearsay) associated with eight general methodologies (i.e., experimental studies, quasi-experimented studies, correlational status studies, surveys, studies of personnel, systematic expert judgment studies, clinical or case studies, and informal observation and/or testimony) frequently used by evaluators.

All ten sources of information are rarely used in a single evaluative study. What is crucial, however, is that the evaluator attempts to tap more than a single source of information within a particular evaluative study. The remainder of this paper presents illustrative data (i.e., test scores and questionnaire responses) which were obtained in an evaluation of the Math Anxiety Program in Continuing Education for Women at the University of Minnesota.

Method

Subjects

The initial pool of subjects for the present study were the 69 female participants (only two males participated) in the Math Anxiety Program. The program, designed for individuals who have math anxiety and/or are unable to do well in typical mathematics courses, consisted of three components: (a) a three-hour diagnostic clinic designed to provide participants with an assessment of their mathematics skills and how math anxiety might be contributing to this poor performance; (b) three special mathematics courses in which the instructors were chosen for their sensitivity to students who have difficulty with mathematics; and (c) a support group, led by a counseling psychologist, which included exercises to reduce math anxiety and provided the participants with a forum for discussing their previous mathematics experiences.

Participants' ages ranged from 19 to 59; the mean age was 37.2 (SD = 9.91) with a mode of 27. Although participants varied in educational background, the majority either had completed some college (32.4%) or had a four-year college degree (22.5%). Less than half (43.7%) had previously been enrolled in other courses offered through Continuing Education for Women and about one-fourth of the women were currently day school students at the university. An average of 18.6 years had elapsed since the women had received formal mathematics instruction but approximately one-third (32.4%) of them had completed a math course since they had graduated from high school.

Procedures

The diagnostic clinic was held on September 8, 1976. About two weeks after the diagnostic clinic, the 69 participants received a summary of their mathematics test performance together with a recommendation concerning registration in one of the three mathematics courses. The mathematics courses began September 27, 1976 and continued through the end of January 1977; the support group began at the same time and met for seven weeks for one and one-half hours each week.

Participants in the diagnostic clinic had one of three options: not continue in the program during fall semester, enroll in one of the three mathematics classes, or enroll in a class and concurrently participate in the support group. The numbers of individuals who chose each of the three options were 32, 22, and 15, respectively.

The follow-up assessment of mathematics anxiety was conducted in February 1977, approximately two weeks after the completion of the course. A second copy of the MARS, together with an appropriate cover letter was sent to all 69 women who participated in the diagnostic clinic. Participants who enrolled in the first course "Arithmetic and Elementary Algebra" also received a copy of the Arithmetic Placement Test. Three evaluation questionnaires (i.e., one for the diagnostic clinic, one for the mathematics course, and one for the support group) were included when appropriate. Completed MARS were received from 28 (87.5%) of the 32 participants in only the diagnostic clinic, from eight (36.4%) of the 22 women who enrolled in a mathematics course, and from 11 (73.3%) of the 15 women who participated in both a mathematics course and the support group.

Instruments

The Mathematics Anxiety Rating Scale (MARS; Richardson and Suinn, 1972) was used to measure initial and post-intervention levels of math anxiety. The MARS consists of 94 items, each of which is scored from 1 to 5, and results in a single scale which may range from a low of 94 to a high of 470. In addition to measuring the intensity of a person's math anxiety, the MARS is useful in diagnosing which situations are particularly anxiety producing, information which is helpful in designing appropriate intervention strategies to reduce math anxiety.

The Arithmetic Placement Test was a 68-item multiple choice test which covered thirteen content areas (e.g., Percentages, Ratios, Properties of Numbers, etc.) and yielded 13 sub-test scores and a single total score which could range from a low of 1 to a high of 68.

The three evaluation questionnaires were developed to obtain participants' evaluation of the diagnostic clinic, the three mathematics classes, and the support group. All participants in the diagnostic clinic were sent a copy of the "Diagnostic Clinic Evaluation Questionniare" which included questions about how the diagnostic clinic helped participants achieve their goals, reactions to each aspect of the diagnostic clinic, overall effectiveness of the diagnostic clinic, and suggestions concerning how the diagnostic clinic could be improved. The second questionnaire, the "Course Evaluation Questionnaire," was sent to all students who enrolled in any of the three math classes. The questionnaire contained items concerning the extent to which the courses fulfilled their goals, a series of 16 specific items concerning various aspects of each of the courses, overall effectiveness of the course, and ways in which the course could be improved. The "Support Group Evaluation Questionnaire" was sent to all individuals who attended the first session of the support group. This questionnaire was developed to obtain feedback concerning the effectiveness of the support group as a technique for helping individuals overcome their fears concerning mathematics.

Data Analysis

One way analysis of variance was used to examine differences between the three groups on initial MARS score and on post-intervention MARS score.

Repeated measures t-tests were used to compare pre-intervention and post-intervention MARS scores within each of the three groups and to compare pre-course and post-course arithmetic scores for the participants who enrolled in Arithmetic and Elementary Algebra. Descriptive statistics were calculated for each item on the three evaluation questionnaires.

Results

Results are discussed in terms of comparisons of initial and post-intervention levels of mathematics anxiety, initial and post-course mathematics performance, and participants' evaluations of the three components of the program.

Mathematics Anxiety

Because not all 69 participants in the diagnostic clinic completed the MARS a second time, the question as to the representativeness of the complete data sets arose. Participants who completed the MARS only in September 1976 were compared with those who completed the MARS twice to determine differences between the two groups on initial MARS score. Results indicated that those who did not complete the MARS a second time had initially higher MARS scores than individuals who completed the MARS twice (M = 277.74, SD = 64.15 and M = 242.20, SD = 61.09, respectively; t = -2.21, $p \leq .05$).

The two MARS scores were compared for the 47 individuals who completed the MARS twice. The 47 individuals differed in terms of their involvement in the program: some participated in the diagnostic clinic, some enrolled in a mathematics course, and some also participated in the support group. Comparisons between mean MARS scores, across the three "degree of involvement" groups, indicated significant lower mathematics anxiety in February 1977 than in September 1976 (M = 210.11, SD = 64.11 versus M = 242.20, SD = 61.09, respectively; t = 4.42, $p \leq .001$).

If degree of involvement is positively related to greater decreases in mathematics anxiety, one would hypothesize that the program would be most effective in reducing mathematics anxiety for those individuals who enrolled in a mathematics class and also participated in the support group. Table 1 generally confirms this hypothesis. Table 1 contains the results of both the one way analysis of variance and the repeated measures t-tests for individuals who completed the MARS twice. Although the three groups did not differ significantly when they took the MARS in September 1976, they did differ significantly (F = 6.11, $p \leq .01$) at the post-intervention testing

---

Insert Table 1 about here

---

session. Repeated measures t-tests within each of the three groups indicated that although all three groups decreased significantly on math anxiety, the decrease was greatest for individuals who had participated in both a mathematics course and the support group. The average decrease in MARS scores for individuals who participated in the program to its fullest was approximately 75 points. By way of contrast, individuals who participated in only the diagnostic clinic had a decrease in mathematics anxiety of approximately

14 points. Results contained in Table 1 indicate that individuals who enrolled in a mathematics course but not in the support group, tended to have relatively low MARS scores at the initial testing, but they, too, were less anxious in February 1977 than they were the previous September.

Mathematics Performance

Because of the small number of individuals in Intermediate Algebra and in College Algebra and Analytic Geometry and because of the inappropriateness of the Arithmetic Placement Test for measuring change (i.e., ceiling effect and test content), assessment of changes in mathematics performance was limited to diagnostic clinic participants (N=12) who enrolled in and completed the Arithmetic and Elementary Algebra.

Individuals who enrolled in Arithmetic and Elementary Algebra had lower initial scores than both other groups of diagnostic clinic participants who enrolled in one of the other two courses and participants who did not enroll in any of the three courses. But results also indicated significantly higher post-course than pre-course scores on the Arithmetic Placement Test (M = 61.4, SD = 3.41 versus M = 36.7, SD = 6.88, respectively; t = -13.84, $p \leq .001$). Analysis of changes for each of the 13 subtests indicated significantly higher ($p \leq .05$) post-course scores for 10 of the subtests. The largest changes were for Properties of Numbers, Ratios, Rates and Proportions, and Problem Solving items.

Participants' Evaluations

Fifty-one participants (72.8%) returned their completed "Diagnostic Clinic Evaluation Questionnaire." The first section of the questionnaire dealt with goals of the Math Anxiety Program and the extent to which participants accomplished their various goals. The goal list was developed from questions administered during the diagnostic clinic held the previous September. Table 2 contains a list of the various goals, the number of participants who indicated the goal as one of their specific goals, and the degree to which the goal was accomplished.

Approximately three-fourths of the participants responded favorably to the various aspects of the diagnostic clinic. Two other items dealt with participants' overall evaluation of the three-hour diagnostic clinic. For the general items, it is likely that respondents' evaluations of other components of the Math Anxiety Program may have influenced their responses to these general items. The first such question was "How would you rate the overall effectiveness of the diagnostic clinic?" Responses were as follows: "extremely ineffective" (N = 1 or 2.0%), "very ineffective" (N = 6, or 11.8%), "somewhat ineffective" (N = 2, or 3.9%), "somewhat effective" (N = 10, or 19.1%), "very effective (N = 15, or 29.4%), "extremely effective" (N = 4, or 7.8%); the average response was 4.57 (SD = 1.52). The second question asked participants to indicate "How much would you say you learned as a result of the diagnostic clinic?" On a seven point scale from "very little" (coded 1) to "a tremendous amount" (coded 7), the average response was 4.14 (SD = 1.30), which was slightly higher than "much" (coded 4).

Correlations were obtained between responses to these two general items and participants' responses concerning the degree to which their goals had been met. Results indicated statistically significant correlations for one of the eight goals: to evaluate my math abilities. Correlations were .33 ($p \leq .01$) and .46 ($p \leq .001$), respectively, for the two general items. The degree to

which individuals felt that the diagnostic clinic helped them to evaluate their mathematics skills was positively related to overall evaluation of the diagnostic clinic.

Participants who enrolled in one of the mathematics courses responded, on a seven-point scale from "very strongly disagree" (coded 1) to "most strongly agree" (coded 7), to a series of 16 specific items concerning various aspects of each of the courses. Response means for all three courses indicated very favorable evaluations of the courses (i.e., students ranged from moderately agree to most strongly agree for most of the items). Students also responded to two general items concerning overall effectiveness of the course and self-estimates concerning how much they learned in the course. Table 3 contains a description of those results for each of the three courses. Results contained in this table confirm the results concerning students' evaluations of specific aspects of the course.

Fifteen individuals participated in one or more of the sessions of the support group. Each of those individuals received a copy of the "Support Group Evaluation Questionnaire." Attendance at the support group was not as regular as might have been hoped. Participants indicated how many of the sessions they attended as follows: one (N = 1, or 9.1%), three (N = 2, or 18.2%), four (N = 3, or 27.3%), five (N = 3), and six (N = 2). These respondents were consistent with the leader's impressions concerning attendance.

The support group included a number of different activities dealing with mathematics anxiety. Participants evaluated each activity in terms of whether or not they felt the activity was beneficial and then commented about the strengths/weaknesses of the activity. Specific results concerning participants' evaluations of the various components of the support group are contained in Hendel (Note 4).[1]

Two questions dealt with overall evaluations (i.e., effectiveness and self-estimated learning) of the support group. On a seven point scale (1 = "extremely ineffective" to 7 = "extremely effective"), the average rating concerning overall effectiveness of the support group was 4.13 (SD = .64) which was between "somewhat effective" (coded 4) and "very effective" (coded 5). On a similar seven-point scale concerning learning which occurred in the support group (1 = "very little" to 7 = "tremendous amount"), the average rating was 3.50 (SD = 1.31) which was midway between "some" and "much."

Discussion

Systematic evaluation can contribute to development and implementation of programs designed to alleviate mathematics anxiety. By providing diagnostic information to program developers, instructors and counseling staff, evaluation also can encourage program staff to be more empirical in their assessment of the effectiveness of various components of the program. But given the newness of most programs, evaluations designed to assess the overall worth of the program for purposes of making decisions about continuation of the program seem inappropriate at this time.

Results of the study described in the present report have been used in diagnosing strengths and weaknesses of the Math Anxiety Program at the University of Minnesota. The diagnostic clinic will be slightly longer, will include more discussion of mathematics instruction and mathematics

anxiety, and will increase the testing emphasis for mathematics comprehension and decrease the emphasis on mathematics anxiety. But its major purposes and overall format will remain the same. The mathematics courses will not be changed noticeably. The general ways in which the support group will be changed have been noted in an earlier presentation in this symposium.

Mathematics anxiety can be dealt with in several ways. Results of the present study suggested that the most effective intervention strategy may be one that includes two separate components, one which deals with the affective component and another which focus on the cognitive aspect of the problem. Future studies concerning treatment programs for mathematic anxious individuals should attempt to examine the effectiveness of different instructional techniques (e.g., self-paced, standard classroom instruction, etc.) and different counseling techniques (e.g., systematic desensitization, rational-emotive, etc.) in dealing with mathematics anxiety. It seems likely that different procedures also may be more or less effective with different groups of clients.

Reference Notes

1. Ball, S. Comment made in a presentation at the Math Avoidance and Math Anxiety Training Institute, Wesleyan University, June 1977.

2. Ball, S. & Anderson, S. B. Professional issues in the evaluation of eduation/training programs. Educational Testing Service: Princeton, N. J., 1975.

3. Ernest, J. Mathematics and sex. University of California; Santa Barbara, California, 1976.

4. Hendel, D. D. The Math Anxiety Program: Its Genesis and Development in Continuing Education for Women. Measurement Services Center, University of Minnesota: Minneapolis, Minnesota, 1977.

References

Fennema, E. & Sherman, J. Sex-related differences in mathematics achievement, spatial visualization and affective factors. American Educational Research Journal, 1977, 14, 51-71.

Lazarus, M. Mathophobia: Some personal speculations. National Elementary Principal, 1974, 53, 16-22.

Maccoby, E. E. & Jacklin, C. N. Psychology of sex differences. Palo Alto, California: Stanford University Press, 1974.

Richardson, F. & Suinn, R. M. The Mathematics Anxiety Rating Scale: Psychometric data. Journal of Counseling Psychology, 1972, 19, 551-554.

Scriven, M. The methodology of evaluation. In B. R. Worthen & J. R. Sanders (Eds.), Educational evaluation. Theory and practice. Worthington, Ohio: Charles A. Jones Publishing Company, 1973.

Stufflebeam, D. L., Foley, W. L., Gephart, W. J., Guba, E. G., Hammond, R. L., Merriman, H. O., & Provus, M. M. Educational evaluation and decision making in education. Itasca, Ill.: Peacock, 1971.

Tobias, S. Math Anxiety. Ms Magazine, Fall, 1976, 56-59.

Footnotes

[1]Copies of the complete evaluation report, which includes more extensive information concerning participants' evaluations of the three components are available for $3.50. The report is entitled "The Math Anxiety Program: Its Genesis and Evaluation in Continuing Education for Women" and is available from the Measurement Services Center, University of Minnesota, 9 Clarence Avenue S. E., Minneapolis, MN 55414.

Table 1

A Comparison between Pre-Intervention and Post-Intervention MARS Scores, by Group

Group	September 1976 M	September 1976 SD	February 1977 M	February 1977 SD	t-value
Diagnostic Clinic Only (N = 28)	248.71	58.16	234.39	66.88	2.17*
Course Only (N = 8)	207.12	60.27	169.87	46.29	2.60*
Course and Support Group (N = 11)	251.18	65.56	177.54	34.91	3.78**
	F (2, 45) = 1.64		F (2, 45) = 6.11**		

*p ≤ .05

**p ≤ .01

Table 2

Participants' Descriptions of Goals Accomplished

Goal	Number Expressing This As A Goal	Not at All N	Not at All %	A Little N	A Little %	Fairly Well N	Fairly Well %	Very Well N	Very Well %	Exceptionally Well N	Exceptionally Well %	M	SD
To eliminate fears, get rid of mental blocks	34	4	11.8	9	26.5	9	26.5	10	29.4	2	5.9	2.91	1.14
To gain self-confidence, self improvement	37	2	5.4	5	13.5	13	35.1	12	32.4	5	13.5	3.35	1.06
To evaluate my mathematics abilities	43	—	—	3	5.9	13	25.5	15	29.4	12	23.5	3.84	.92
To improve existing skills	34	7	28.6	3	8.8	6	17.6	12	35.3	6	17.6	3.21	1.41
To learn basics, understand fundamentals	35	6	17.1	2	5.7	5	14.3	15	42.9	7	20.0	3.43	1.36
To facilitate my getting either undergrad or graduate degree	17	3	17.6	4	23.5	4	23.5	5	29.4	1	5.9	2.82	1.24
To become more comfortable doing practical math (e.g., income tax, sewing)	15	3	12.0	5	20.0	4	16.0	9	36.0	4	16.0	3.24	1.30
To increase my employability	16	1	6.3	3	18.8	7	43.8	3	18.8	2	12.5	3.13	1.09

Table 3

Students' Responses to General Course Evaluation Items

Item / Course	Response Categories												M	SD
How would you rate the overall effectiveness of the course?	Extremely Ineffective N	%	Very Ineffective N	%	Somewhat Ineffective N	%	Somewhat Effective N	%	Very Effective N	%	Extremely Effective N	%	Superbly Effective N	%		
Arithmetic and Elementary Algebra	--	--	--	--	--	--	3	13.6	7	31.8	10	45.5	2	9.1	5.50	.86
Intermediate Algebra	--	--	--	--	1	16.7	1	16.7	1	16.7	2	33.3	1	16.7	5.17	1.47
College Algebra and Analytic Geometry	--	--	--	--	--	--	--	--	2	33.3	3	50.0	1	16.7	5.83	.75
How much have you learned as a result of this course?	Very Little N	%	Little N	%	Some N	%	Much N	%	Very Much N	%	Very Very Much N	%	A Tremendous Amount N	%		
Arithmetic and Elementary Algebra	--	--	--	--	2	9.1	4	18.2	5	22.7	8	36.4	3	13.6	5.27	1.20
Intermediate Algebra	1	16.7	--	--	--	--	1	16.7	2	33.3	1	16.7	1	16.7	4.67	2.07
College Algebra and Analytic Geometry	--	--	--	--	--	--	--	--	2	33.3	3	50.0	1	16.7	5.83	.75

Figure 1

Evaluation Flow Chart:
Development, Evaluation and Revision
of Mathematics Anxiety Programs

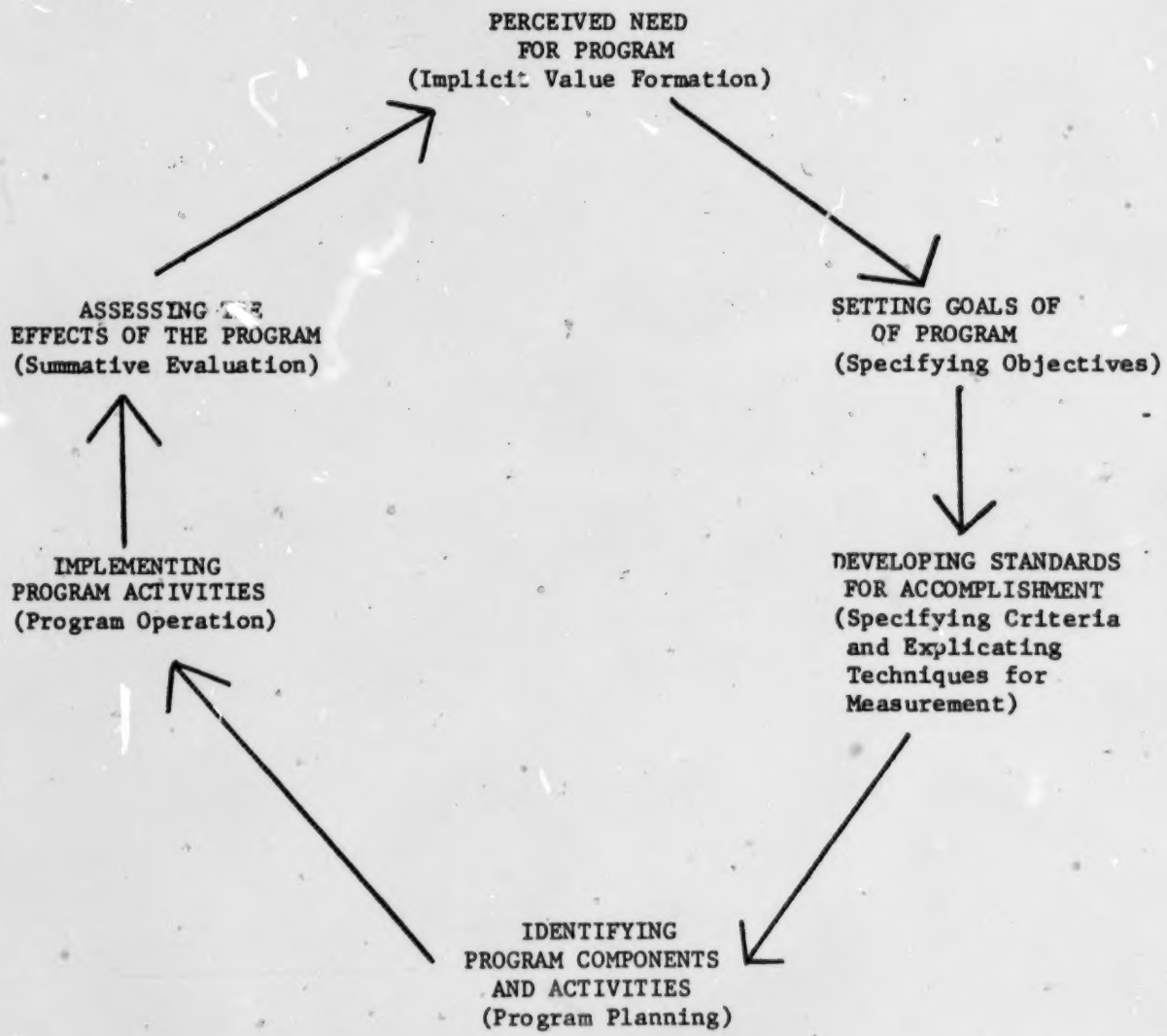
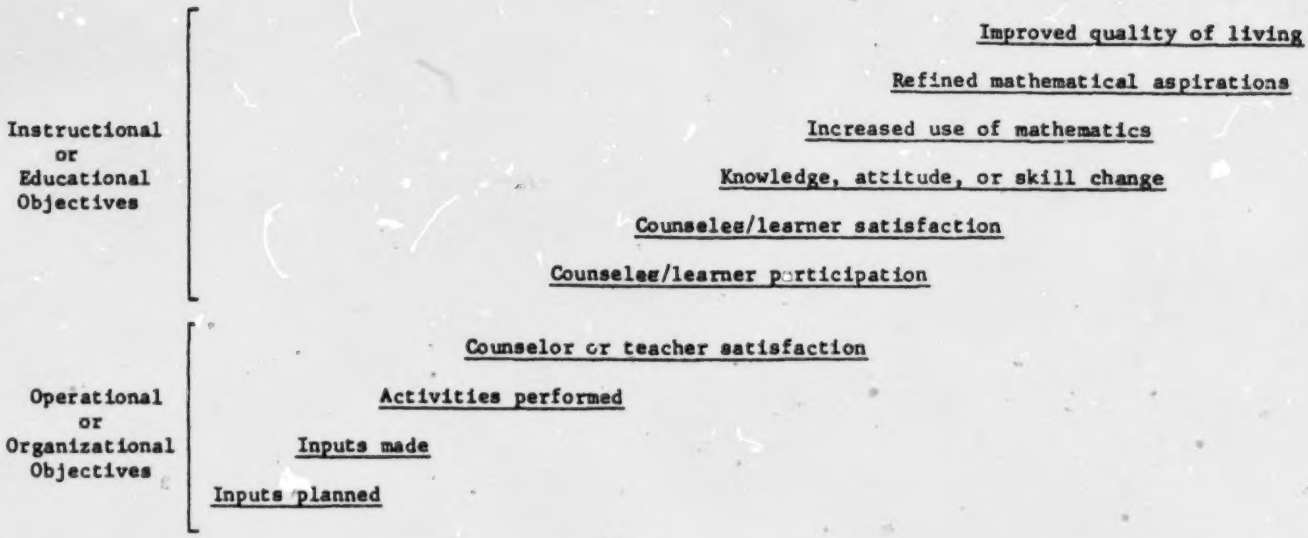


Figure 2

Levels of Evaluation for Mathematics Anxiety Program



1. Inputs planned: How much time and resources were allocated to the program? Was the plan made appropriate for the counseling and instructional activities? Was the program considered high priority?

2. Inputs made: How many hours were spent in the various program activities? How many counselors, teachers or other resources were used? Were suggestions from other professionals obtained? How much money was spent on the program? Were the allocations of time, money or resources adequate?

3. Activities performed: What meetings were held? How many contacts with other counselors were made? How many news releases, radio programs, etc., were made? Were consultations used? How many referrals were received and made?

4. Counselor/teacher satisfaction: Did the activities generally please or displease the counselors and teachers? Were the counselors and educators satisfied with their effort or performance? Are they willing to work with the program again?

5. Counselee/learner participation: How many clients participated? How did they find out about the program? Were the right people in attendance? Did the clients read the information concerning the development of mathematics anxiety?

6. Counselee satisfaction: Did the participants enjoy the activities? Would they come again to another similar program? Did they appear to be pleased with the group activities? Did they feel good while participating in the program?

7. Knowledge, attitude, or skill change: Did the learner know something different as a result of the activity? Did the activity cause the learner to change emotionally or in his or her attitude concerning mathematics? Did the learner acquire a new skill? Did the counselees become less anxious about mathematics?

8. Practice adoption: Did the counselee use the new knowledge, attitude, or skill in his or her personal or occupational activities? Can you see new practice in evidence by the learners who participated?

9. Refined mathematical aspirations: Did the learner improve his/her plans for personal growth because of the activity? Did the counselee revise his/her career plans?

10. Improved quality of living: Did the counselee improve her/his living standards because of the activity? Are counselees living fuller, more satisfying lives because of participation in the program? Are they enrolling in mathematics oriented curricula and becoming employed in occupations which use mathematics?

Figure 3

Stuffelbeam's Typology of Educational Evaluation: The CIPP Model

	CONTEXT EVALUATION	INPUT EVALUATION	PROCESS EVALUATION	PRODUCT EVALUATION
OBJECTIVE	To define the operating context, to identify and assess needs and opportunities in the context and to diagnose problems underlying the needs and opportunities.	To identify and assess system capabilities, available input strategies, and designs for implementing the strategies.	To identify or predict, in process, defects in the procedural design or its implementation, to provide information for the preprogrammed decisions, and to maintain a record of procedural events and activities.	To relate outcome information to objectives and to context, input, and process information.
METHOD	By describing the context; by comparing actual and intended inputs and outputs; by comparing probable and possible system performance; and by analyzing possible causes of discrepancies between actualities and intentions.	By describing and analyzing available human and material resources, solution strategies, and procedural designs for relevance, feasibility and economy in the course of action to be taken.	By monitoring the activity's potential procedural barriers and remaining alert to unanticipated ones, by obtaining specific information for programmed decisions, and describing the actual process.	By defining operationally and measuring criteria associated with the objectives, by comparing these measurements with predetermined standards or comparative bases, and by interpreting the outcomes in terms of recorded context, input and processes information.
RELATION TO DECISION-MAKING IN THE CHANGE PROCESS	For deciding upon the setting to be served, the goals associated with meeting needs or using opportunities, and the objectives associated with solving problems, i.e., for planning needed changes.	For selecting sources of support, solution strategies, and procedural designs, i.e., for structuring change activities.	For implementing and refining the program design and procedure, i.e., for effecting process control.	For deciding to continue, terminate, modify, or refocus a change activity to other major phases of the change process, i.e., for recycling change activities.